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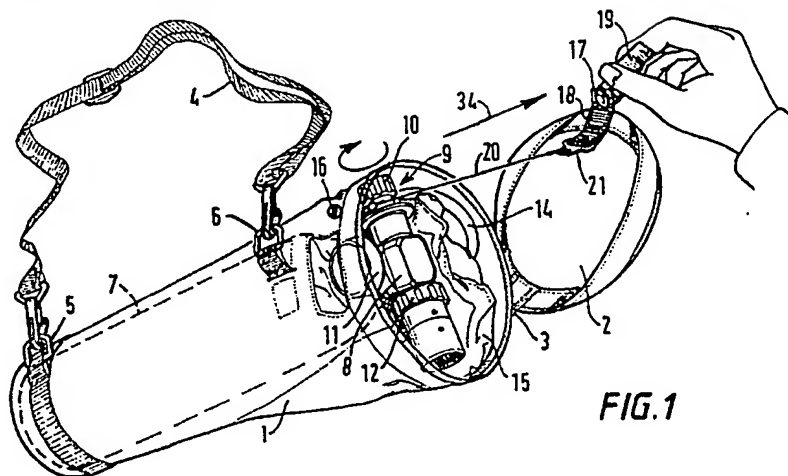
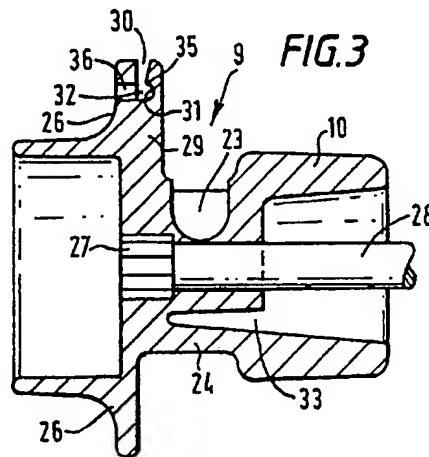
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## (54) Breathing apparatus with quick-fire gas releasing device

(57) A quick-fire release device for emergency escape breathing apparatus which initiates the flow of breathable gas from a gas storage device 7 to a hood 15 on opening the pack in which the apparatus is stored. A cord 20 is wrapped twice around a cord winding section 24 of a handwheel 9, which opens and closes a valve which controls the flow of gas to the hood 15. The handwheel 9 also has a disk portion 26 which is of a larger diameter than the cord winding section 24; close to the circumference of this disk portion 26 is a snap-in holder 30, 31, 35 through which the cord 20 passes before being attached to the openable lid 2 of the pack. Because the disk portion 26 is of a larger diameter than the cord winding section 24 the handwheel 9 initially rotates slowly as the pack is opened by unfastening its closure portion 2 from its storage portion 3, and the cord 20 unwinds from the snap-in holder, and then rotates more quickly as the cord 20 unwinds from the cord winding section 24.



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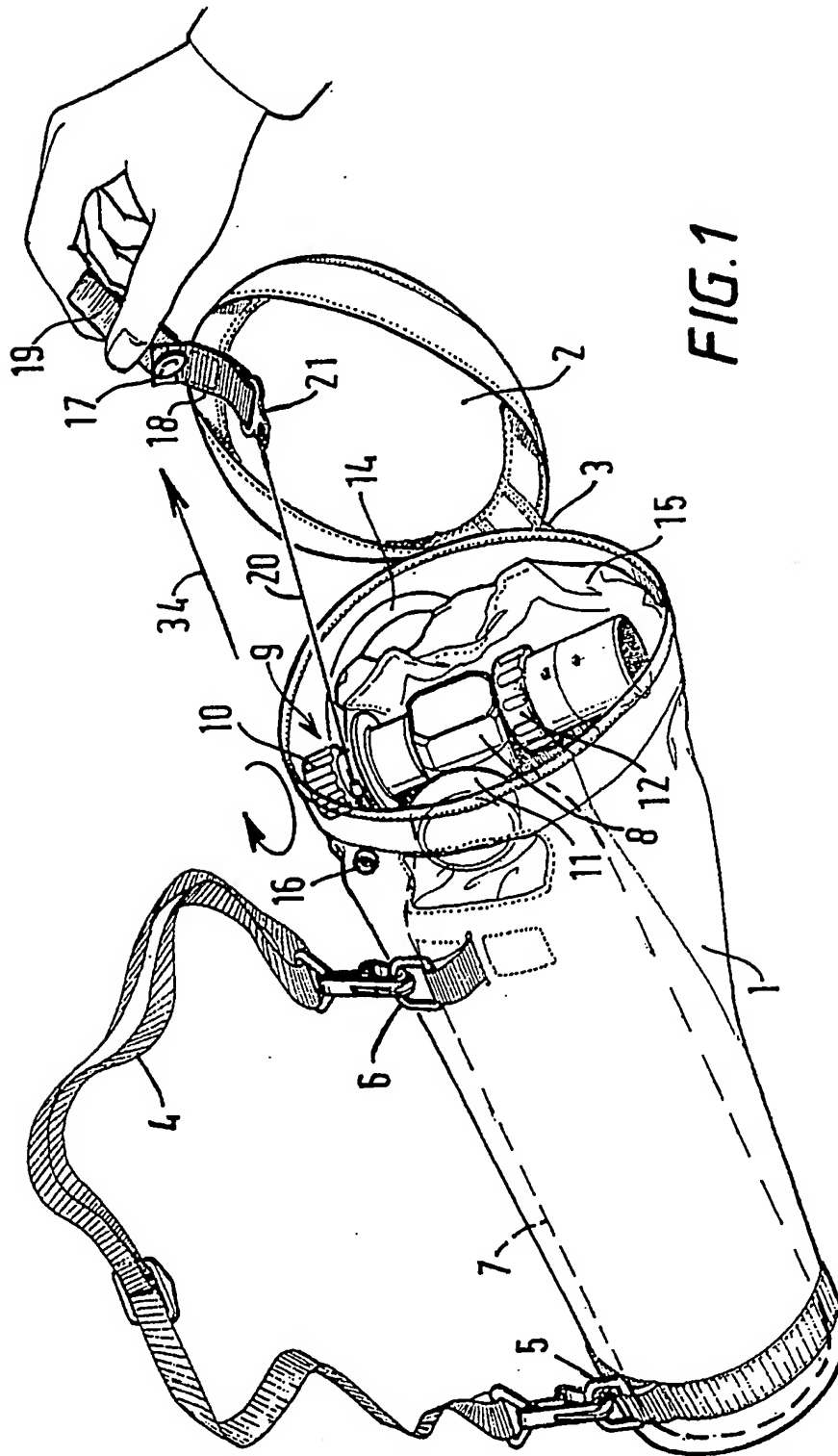
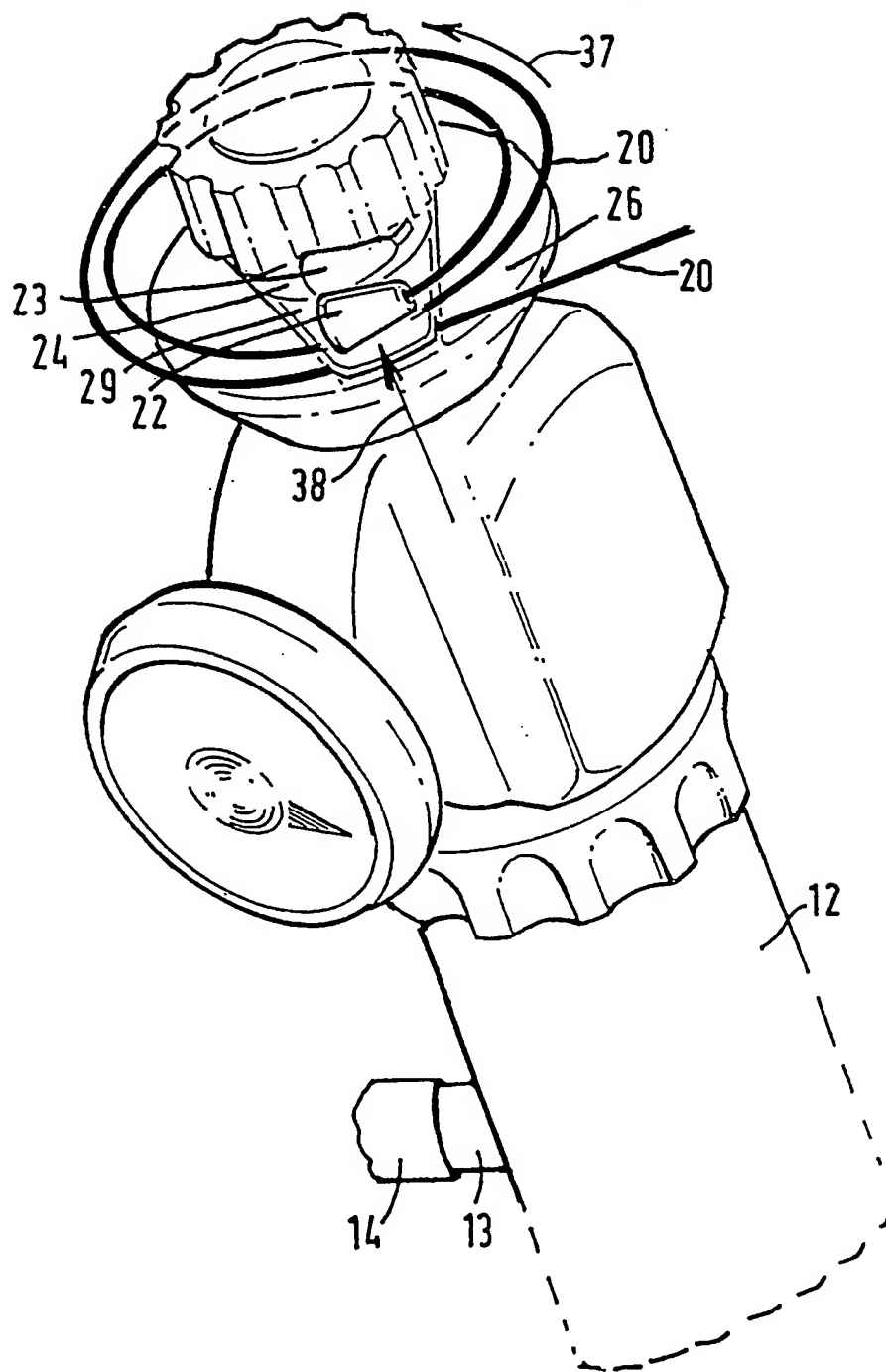
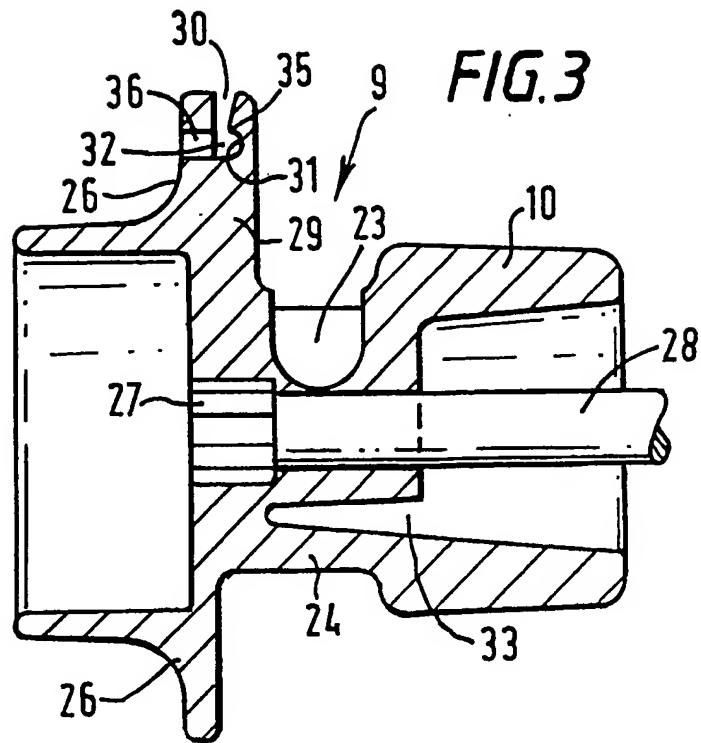


FIG. 1

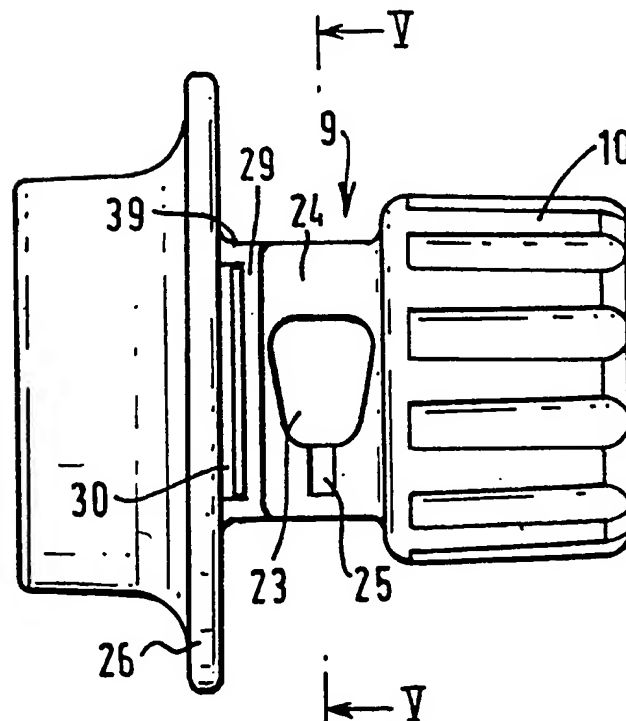
FIG. 2



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**FIG. 4**



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FIG. 5

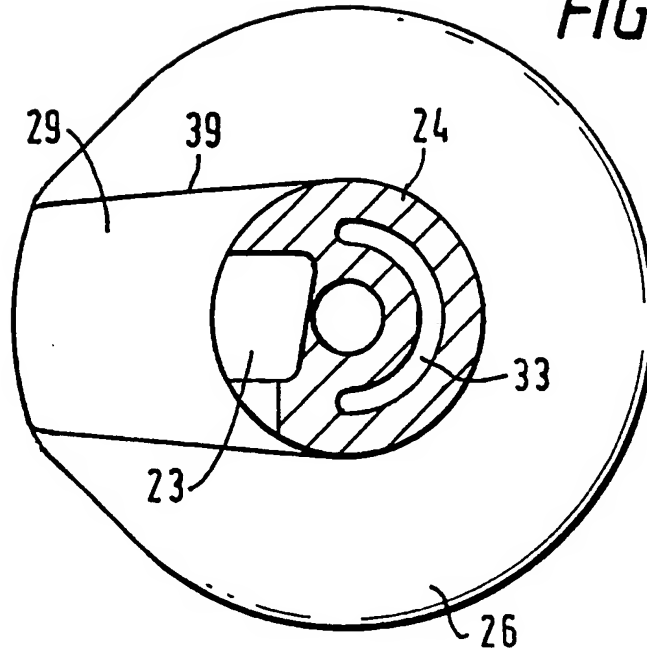
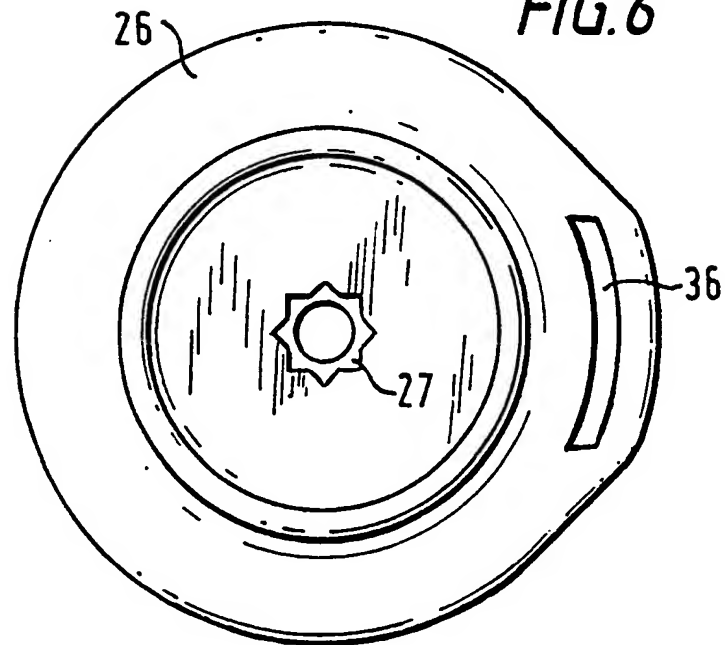


FIG. 6



## EMERGENCY ESCAPE BREATHING APPARATUS

This invention relates to emergency escape breathing apparatus including a quick-fire release device for initiating flow of breathable gas.

Known emergency escape breathing apparatus,  
5 comprises a pack containing a compressed gas storage container, such as a compressed air cylinder, together with a hood or a face mask connected by a hose to a control valve on the gas cylinder. When this emergency escape breathing apparatus is to be used,  
10 the valve controlling the release of gas from the gas cylinder must be opened and the hood or face mask donned so that a person may pass through a noxious atmosphere to a safer region.

When the emergency escape breathing  
15 apparatus has to be used in the event of a sudden emergency such as the outbreak of fire, it is important for the individual caught in the emergency to be able to commence use of the emergency escape breathing apparatus very speedily. In such  
20 circumstances the necessity to turn an on/off valve sufficiently to obtain a suitable flow of breathable gas from the cylinder can result in undesired delay in making the emergency escape breathing apparatus effective. Accordingly proposals have been made for a  
25 quick-fire mechanism for initiating discharge of the gas from the cylinder to the hose leading to the hood or face mask. Generally known quick-fire devices have operated on medium pressure gas and not on the high pressure gas which emerges from the gas outlet which  
30 is connected directly to the compressed gas within the cylinder or other storage container.

In consequence the emergency escape breathing apparatus including such quick-fire devices has of necessity contained seals for sealing both the  
35 high pressure gas and the medium pressure gas at the point of operation of the quick-fire device.

Inevitably the use of such a number of seals gives rise to a greater risk of leakage of gas from the emergency escape breathing apparatus during storage before the equipment is needed and therefore to a danger that, when required, there may be insufficient gas remaining within the storage container.

Accordingly it is an object of the present invention to provide emergency escape breathing apparatus having a quick-fire device which acts on the high pressure gas at the gas outlet from the compressed gas storage container.

It is a further object of the present invention to provide emergency escape breathing apparatus having a quick-fire device which is simple, easy to operate and reliable.

According to the present invention there is provided emergency escape breathing apparatus comprising a pack having a storage portion, a closure portion, and fastening means for securing the closure portion to the storage portion, a gas storage device containing compressed breathable gas secured within the storage portion, a flexible hose connected to an outlet from the gas storage device, respiratory protective means connected to the flexible hose, the flexible hose and the respiratory protective means being loosely stored in the storage portion, and the compressed gas storage device including a quick-fire device for initiating flow of breathable gas from the gas storage device to the respiratory protective means, the quick-fire device including an operating cord connected at one end to the closure portion of the pack and releasably connected at the other end to a wheel member on which the operating cord is partially wound, the wheel member being mounted on a shaft controlling gas flow from the gas storage device, whereby the action of opening the pack by

moving the closure portion thereof away from the storage portion causes the operating cord to rotate the wheel member and initiate flow of breathable gas to the respiratory protective means.

5            Preferably the quick-fire device includes further means for causing the wheel member to rotate initially at one speed and subsequently at a higher speed after flow of breathable gas from the gas storage device has commenced.

10           In the embodiment of the present invention which will be described the further means for causing the wheel member to rotate initially at one speed and subsequently at a higher speed comprises a cord-winding section on the wheel member, a disk of  
15 substantially greater diameter than the cord-winding section and adjacent to the cord-winding section, and snap-in holder means on the disk for receiving and retaining a length of the operating cord near a portion of the circumferential edge of the disk.

20           Preferably the snap-in holder means on the disk defines a chord on the disk, the ends of the chord each making an angle of the order of 10° with the tangent at the point of intersection of the chord with the circumference of the disk.

25           Advantageously the surface of the disk adjacent the cord-winding section of the wheel member includes a raised portion extending from the surface of the cord-winding section to a position adjacent the circumference of the disk to form therewith the snap-  
30 in holder means.

             Preferably the snap-in holder means is constituted by a circumferential opening between the disk and the raised portion thereof, the opening including a restriction beyond which is a groove  
35 having a concave internal surface.

             Conveniently the operating cord is



releasably connected to the wheel member by locating a shaped retaining member secured to the said other end of the operating cord in a similarly shaped recess in the cord-winding section of the wheel member.

5           The recess in the surface of the cord-winding section of the wheel member may be substantially conically shaped in order to receive a substantially conically shaped retaining member secured to the said other end of the operating cord.

10   The use of a conical shape ensures that the retaining member is inserted the right way round into the recess and the cord is correctly wound on the wheel member. Other shapes of recess and retaining member capable of securing the same result may be used.

15           In the preferred embodiment of the present invention the wheel member further includes a hand knob for rotating the shaft to initiate flow of breathable gas from the gas storage device independently of operation of the quick-fire device.

20   The provision of the hand knob enables the user of the emergency escape breathing apparatus to turn the supply of breathable gas on manually in the event of failure of the automatic quick-fire device.

          The respiratory protective means may be a hood which completely envelopes the head of a wearer or it may be a face piece, preferably a full face mask, or a mouth piece.

          The present invention will be further understood from the following detailed description of a preferred embodiment thereof which is made, by way of example, with reference to the accompanying drawings in which

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          Figure 1 is a perspective view of emergency escape breathing apparatus in accordance with the present invention immediately after opening of the pack

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Figure 2 is an enlarged perspective view of a part of the emergency escape breathing apparatus of Figure 1 showing diagrammatically the cooperation between the operating cord and the wheel member of the quick-fire device

Figures 3 and 4 are respectively a cross-sectional side view and a plan view of a handwheel constituting the wheel member of the quick-fire device

Figure 5 is a cross-sectional view of the handwheel of Figures 3 and 4 taken along the line V - V of Figure 4, and

Figure 6 is an end view of the handwheel of Figures 3 to 5 viewed from the left-hand side of Figure 4.

In the accompanying drawings the same or similar parts are designated by like reference numerals.

Referring first to Figure 1 of the accompanying drawings there is shown emergency escape breathing apparatus including a pack which comprises a storage portion 1 and a flap closure portion 2, the flap closure portion 2 being hinged to the storage portion 1 by a webbing hinge 3. An adjustable strap 4 secured to the storage portion 1 of the pack by appropriate anchor means such as D-rings 5 and 6 enables the weight of the emergency escape breathing apparatus to be supported on the shoulders of the user.

The prime weight of the emergency escape breathing apparatus consists of a compressed gas storage cylinder 7 (indicated in broken lines in Figure 1) secured within the storage portion 1 of the pack. The compressed gas in the gas storage cylinder 7 is usually air and the gas storage cylinder 7 is

advantageously suspended from the inner surface of the storage portion 1 of the pack to the outer surface of which the anchor means 5 and 6 are secured.

The compressed air cylinder 7 includes a connection block 8 containing a control valve (not shown) for controlling release of gas from the cylinder 7. The control valve within the connection block 8 is opened or closed by rotation of a shaft under the action of a handwheel which is indicated generally by the reference numeral 9 and which includes both a hand knob 10 and a wheel member which is part of the quick-fire device of the present invention and which will be described in detail below.

Also mounted to the connection block 8 are a pressure gauge 11 indicating the pressure of gas in the cylinder and a pressure reducer 12 to a gas outlet 13 from which a flexible hose 14 is connected as shown in Figure 2.

Connected to the flexible hose 14 is a flexible hood 15 constituting the respiratory protective means of this embodiment of the invention. The hose 14 and the hood 15 are loosely stored within the storage portion 1 of the pack below the suspended cylinder 7 as shown in Figure 1 for quick removal and use by a user in an emergency. Other respiratory protective means such as a full face mask or an orinasal mask may be used as an alternative to a hood.

The flexible hose 14 may be connected directly to the hood or other respiratory protective means in a constant flow system, or the connection of the hose to the hood may be through a demand valve (not shown) when the emergency escape breathing apparatus is a demand system.

The pack comprising the storage portion 1 and flap closure portion 2 is normally closed by a suitable fastening means such as a press stud fastener

having cooperating members 16 and 17 located respectively on the outside of the storage portion 1 of the pack and on a connecting strap 18 secured to the interior of the flap closure portion 2 as shown in Figure 1. The connecting strap 18 includes an extension 19 outside the flap closure portion 2 for gripping and pulling by the user to undo the press stud fastener speedily when use of the emergency escape breathing apparatus is required.

The preferred embodiment of emergency escape breathing apparatus according to the present invention illustrated in the drawings includes an operating cord 20 secured at one end to an anchor 21 at the end of the connecting strap 18 which is within the flap closure portion 2. The other end of the operating cord 20 has a conically shaped retaining member 22 attached to it as best shown in Figure 2. The conically shaped retaining member 22 is adapted for location in a similar conically shaped recess 23 in a cord-winding section 24 of a wheel member which is an integral part of the handwheel 9.

The preferred construction of the handwheel 9 will now be described with reference to Figures 3 to 6 of the accompanying drawings.

The handwheel 9 includes the cord-winding section 24 immediately adjacent to fluted hand knob 10, the cord-winding section 24 including the conically shaped recess 23 and a cord-receiving recess 25 leading therefrom as shown in Figure 4. Adjacent to the cord-winding section 24 of the handwheel 9 is a disk 26 of substantially greater diameter than the cord-winding section 24. The internal surface of the handwheel 9 in the region of the disk 26 is splined as shown at 27 in Figures 3 and 6 in order to engage corresponding splines on a control shaft 28, a portion of which is shown in Figure 3.

As shown in Figures 3, 4 and 5 the disk 26 includes a raised portion 29 defining with the disk 26 a snap-in holder for holding a portion of the operating cord 20. The snap-in holder includes an opening 30 between the disk 26 and the raised portion 29 of narrowing width to a restriction defined by a projection 35 (Figure 3) below which is a groove 32 having a concave internal surface 31 capable of receiving part of the cord 20 and permitting free longitudinal movement of the cord 20 within the snap-in holder. The gap between the projection 35 on the raised portion 29 and the disk 26 is less than the diameter of the cord 20 so that the cord 20 does not readily pass through the gap, but must be snapped both into and out of the groove 32.

Preferably the handwheel 9 is made of a resilient plastics material such as ABS or the material obtainable under the trade name DELRIN which are resilient materials and which facilitate snap-in entry of the operating cord 20 through opening 30 past the projection 35 into the groove defined by the concave surface 31. However, when the operating cord 20 is a nylon cord there may be sufficient resilience in the cord itself for the handwheel 9 including the disk 26 and the raised portion 29 to be made of a rigid material such as stainless steel. Conveniently the operating cord 20 is a nylon cord of 1.8mm diameter, and the dimension of the restriction at the gap between projection 35 and the opposite vertical face of the disk 26 is of the order of 1.0 to 1.2mm.

An aperture 36 in the disk 26, shown in Figures 3 and 6 is a moulding feature enabling a protrusion on the mould to form the internal concave surface 31 of the groove 32. A cavity 33 (Figures 3 and 5) is also a moulding feature for facilitating even flow of the plastics moulding material in the

region of the recess 23.

In assembling the quick-fire device of the present invention the conically shaped retaining member 22 is placed in the similarly shaped recess 23 in the cord-winding section 24 of the handwheel 9 with the cord 20 running out of the recess 23 through the cord-receiving recess 25. Two turns of the operating cord 20 are then made around the cord-winding section 24, as shown diagrammatically in Figure 2 with reference to arrow 37.

The shape of the retaining member 22 and the corresponding recess 23 are such as to ensure that the retaining member 22 is placed in the recess 23 in the correct orientation for pull on the operating cord 20 wound around the cord-winding section 24 to rotate the wheel member and the shaft 28 in the direction to open the control valve in connection block 8 and permit gas flow through the pressure reducer 12 and gas outlet 13 to hose 14 and hood 15.

After winding two complete turns of the operating cord 20 on the cord-winding section 24, the cord 20 is taken out from the cord-winding section adjacent the near edge of the raised portion 29 of the disk 26 and a length of the cord 20 is snapped into the groove 32 of the snap-in holder past the projection 35 to the position shown by arrow 38 in Figure 2.

Accordingly the condition of the quick-fire device in the closed condition of the pack is one in which the retaining member 22 is located in recess 23, there are two turns of the cord 20 about cord-winding section 24 and the cord then runs out over the surface of the disk 26, lodging against the raised edge 39 (Figures 4 and 5) of the raised portion 29 before passing through groove 32. The remainder of the operating cord 20 is slack within the pack. The

raised portion 29 of the disk 26 is so positioned in the pack that, when the operating cord 20 is tensioned as the pack is opened, the operating cord 20 extends from the groove 32 substantially tangentially to the disk 26.

When the pack is opened by pulling sharply on the strap extension 19 to undo the press stud fastener 16 and 17 by pulling in the direction of the arrow 34 in Figure 1, the slack in the operating cord 20 is taken up as the flap closure portion 2 is moved away from the storage portion 1 and the operating cord 20 is then caused to rotate the handwheel 9.

Location of the operating cord 20 in the groove 32 of the snap-in holder as described results in the force initially exerted on the handwheel 9 by the operating cord 20 exerting a greater turning moment on the handwheel 9 and the inter-connecting shaft 28 than would be exerted by the operating cord acting directly on the cord-winding section 24. The initial force applied to the handwheel 9 is substantially tangential to the disk 26 and is necessarily a substantial force in order to snap the operating cord 20 out of the groove 32 of the snap-in holder. This initial force results in an initial slow rotation of the handwheel 9 and the shaft 28. Continued application of this force acts on the portion of the operating cord 20 around the cord-winding section 24 of lesser diameter than the disk 26 to turn the handwheel 9 faster after the initial opening of the control valve in the connection block 8 of the gas storage cylinder 7 in consequence of the action of the operating cord 20 on the disk 26.

The initial slow opening of the control valve protects the pneumatic features of the breathing apparatus, in particular reducing the possibility of a sudden surge of pressure in the

pneumatic circuit.

As the handwheel 9 and the shaft 28 are rotated through two revolutions by the operating cord 20, the retaining member 22 comes away from recess 23 and the operating cord 20 hangs loosely from the flap closure portion 2 of the pack permitting unrestricted access to the hood 15 by the user. The user then dons the hood and inhales the air supplied from the gas cylinder 7 to the interior of the hood 15 through hose 14 and, optionally, a demand valve.

In the course of use the closed position of the shaft 28 of the cylinder control valve changes until the raised portion 29 of the disk 26 is no longer in a position where the operating cord 20 exerts a significantly greater moment on the handwheel 9 than it would if wound directly on the cord-winding section 24. The use of an internally-splined handwheel 9 enables the handwheel 9 to be repositioned on the splines of shaft 28 so that the raised portion 29 of the disc 26 is again substantially at right angles to the direction of the tensioned operating cord 20.

Emergency escape breathing apparatus according to the present invention is simple to assemble and use and provides immediate access to the gas supply without any need for the user to spend time operating a handwheel to start the gas flow. Furthermore risk of gas leakage from the storage cylinder is greatly reduced as compared with other quick-fire devices because the quick-fire device of this invention acts on the high pressure gas within the cylinder, rather than on gas at an intermediate pressure leaving the pressure reducer.

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CLAIMS:

1. Emergency escape breathing apparatus comprising a pack having a storage portion; a closure portion, and fastening means for securing the closure portion to the storage portion, a gas storage device containing compressed breathable gas secured within the storage portion, a flexible hose connected to an outlet from the gas storage device, respiratory protective means connected to the flexible hose, the flexible hose and the respiratory protective means being loosely stored in the storage portion, and the compressed gas storage device including a quick-fire device for initiating flow of breathable gas from the gas storage device to the respiratory protective means, the quick-fire device including an operating cord connected at one end to the closure portion of the pack and releasably connected at the other end to a wheel member on which the operating cord is partially wound, the wheel member being mounted on a shaft controlling gas flow from the gas storage device, whereby the action of opening the pack by moving the closure portion away from the storage portion causes the operating cord to rotate the wheel member and initiate flow of breathable gas to the respiratory protective means.
2. Emergency escape breathing apparatus according to Claim 1 including further means for causing the wheel member to rotate initially at one speed and subsequently at a higher speed after flow of breathable gas from the gas storage device has commenced.
3. Emergency escape breathing apparatus according to Claim 2 wherein the further means comprises a cord-winding section, a disk of substantially greater diameter than the cord-winding section to which the disk is adjacent, and snap-in

holder means on the disk for receiving and retaining a length of the operating cord near a portion of the circumferential edge of the disk.

4. Emergency escape breathing apparatus  
5 according to Claim 3 wherein the snap-in holder means on the disk defines a chord on the disk, the ends of the chord each making an angle of the order of 10° with the tangent at the point of intersection of the chord with the circumference of the disk.

10 5. Emergency escape breathing apparatus according to Claim 3 to or Claim 4 wherein the surface of the disk adjacent to the cord-winding section of the wheel member includes a raised portion extending from the surface of the cord-winding section to a  
15 position adjacent the circumference of the disk to form therewith the snap-in holder means.

6. Emergency escape breathing apparatus according to Claim 5 wherein the snap-in holder means is constituted by a circumferential opening between  
20 the disk and the raised portion thereof, the opening including a restriction beyond which is a groove having a concave internal surface.

7. Emergency escape breathing apparatus according to any one of Claims 3 to 6 wherein the  
25 operating cord is releasably connected to the wheel member by locating a shaped retaining member secured to the said other end of the operating cord in a similarly shaped recess in the cord-winding section of the wheel member.

30 8. Emergency escape breathing apparatus according to Claim 7 or Claim 8 wherein the recess in the surface of the cord-winding section of the wheel member is substantially conically shaped.

9. Emergency escape breathing apparatus  
35 according to Claim 3 wherein the wheel member further includes a hand knob for rotating the shaft to

initiate flow of breathable gas from the gas storage device independently of operation of the quick-fire device.

10. Emergency escape breathing apparatus  
5 comprising a pack having a storage portion, a flap closure portion and press-stud fastening means for securing the flap closure portion to the storage portion in a closed condition of the pack, a  
10 compressed air cylinder releasably secured within the storage portion of the pack so that a connection block in the compressed air cylinder is positioned adjacent to the flap closure portion in the closed condition of the pack, a pressure reducer in the connection block, a gas outlet from the pressure reducer, a handwheel  
15 mounted on and rotatable with a shaft rotatably located in the connection block for opening and closing a valve controlling flow of air from the cylinder to the gas outlet, a flexible hose connected to the gas outlet, respiratory protective means  
20 including a demand valve connected to the flexible hose, the respiratory protective means being capable of applying breathable gas from the compressed gas storage device to the respiratory passages of a wearer to the exclusion of environmental gases, the hose and  
25 the respiratory protective means being stored in the storage portion of the pack, the handwheel including a knob for manual rotation of the rotatable shaft, a cord-winding section, a recess in the surface of the cord-winding section, and a disk of substantially  
30 greater diameter than the cord-winding section positioned adjacent to the cord-winding section, an operating cord partially wound on the cord-winding section with one end of the cord secured to the flap closure portion of the pack near to the fastening  
35 means on the flap closure portion and the other end of the cord secured to a retaining member received in the

recess in the cord-winding section and disengageable therefrom, the operating cord passing from the cord-winding section of the handwheel through a snap-in action of separating the press-stud fastening means to  
5 open the flap closure portion of the pack causes the operating cord to be removed from the snap-in groove to rotate the shaft at a first speed to initiate gas flow through the pressure reducer to the demand valve and at a second higher speed as the cord is unwound  
10 from the cord-winding section after gas flow has commenced.

11. Emergency escape breathing apparatus according to any one of the preceding Claims wherein the respiratory protective means is a hood.

15 12. Emergency escape breathing apparatus according to any one of Claims 1 to 11 wherein the respiratory protective means is a face piece.

13. Emergency escape breathing apparatus according to Claim 12 wherein the respiratory  
20 protective means is a full face mask.

14. Emergency escape breathing apparatus constructed and arranged to operate substantially as hereinbefore described with reference to the accompanying drawings.

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**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

16 Application number

GB 9304250.5

**Relevant Technical fields**

(i) UK CI (Edition L ) A5T (TBA TCR TEB)

(ii) Int CI (Edition 5 ) A61M A62B

**Databases (see over)**

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

**Search Examiner**

M SIDDIQUE

**Date of Search**

29 APRIL 1993

Documents considered relevant following a search in respect of claims 1-14

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 878119 (DRAGER) page 2 lines 3-9 etc	1

SF2(p)

HCS - doc99\fil001184



Category	Identity of document and relevant passages 17	Relevant to claim(s)

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